

Interactive comment on “Retrieving volcanic, desert dust, and sea-salt particle properties from two/three-component particle mixtures after long-range transport using UV-VIS polarization Lidar and T-matrix” by G. David et al.

Anonymous Referee #1

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General comments. Combining the observations of a UV-VIS polarization LIDAR and T-matrix numerical simulations of different categories of atmospheric aerosols, the authors of this paper show that it is possible to discriminate the optical properties of the single category of particles in the cases of a (vertically layered) mixture of two or three (aerosol) components, when sampling the air masses apart from the sources of the aerosols. The proposed methodology is convincing and, in my opinion, could arise wide interest in the related atmospheric community. The introduction and the referencing to the current literature are well done. The relevant points, addressed by the

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authors, are well stated, and the conclusions can have a robust background if few points/assumptions are clarified (see Specific comments). The study deserves publication in ACP after considering other minor revisions, mainly: the organization should be improved, as well as the presentation of the analysis:

Paragraph 1, Introduction. It is well done, but it is also quite long. Please consider to insert bulleted lists to summarize part of the discussion, and to improve the readability. Paragraph 2, Methodology. Too many sub-sub sections, they could be reduced if part of the theoretical expressions concerning the light scattering by atmospheric particles are skipped, most of the relevant references are already cited. In this way, the needed formalism for the depolarization of 2- and 3-component particle mixture results more enlightened. Paragraph 5. The sub-paragraphs 5.2.1, 5.2.2 and 5.2.3 are redundant, please remove and leave the corresponding texts in paragraph 5.

Specific comments. To be justified and/or discussed: 1. (page 1899, rows 14-16) why “[...] when mixing sea-salt and desert dust particles, no internal mixture, [...] is assumed”? 2. (page 1904, row 23) explain better because it is possible to assume that there is no interaction between s- and ns-particles. 3. (paragraph 4.3) The ns-particle size distributions (PSDs) have to be assumed, choosing different PSDs how does reflect on the calculation of backscatter coefficient and depolarization? Should this be considered in the estimation of the (systematic) indetermination affecting the retrieved parameters for the different classes of aerosol with your methodology?

Figures 3, 5 and 10. Some human eyes cannot distinguish between green and blue; although efficiently recalling the LIDAR wavelengths, please consider to use different color or line style (thicker) for better viewing.

Technical corrections. (page 1899, rows 16-17) Please rephrase. (page 1924, row 11) Please use “paper” instead of “contribution”